

SPW

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of

NAGULESWARAN et al.

Atty. Ref.: 3127-14

Appl. No. 10/510,473

TC/A.U. TBA

Filed: October 7, 2004

Examiner: TBA

For: METHOD AND RECEIVER FOR PROCESSING A MULTI-USER SIGNAL

\* \* \* \* \*

November 21, 2006

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**RESPONSE**

In a telephonic interview with the Examiner a request for more detailed information as to how the application claims define over references that were deemed "particularly relevant" in foreign search reports was made. Accordingly, with respect to the Learned (US 2002-0037061) reference which was previously submitted and Chennakeshu (USP 6,137,843) which is being submitted in the attached Information Disclosure Statement, Applicants provide the following detailed comments.

The claimed invention is a method and receiver for efficiently decoding multiple TDMA channels, and has particular application in decoding TDMA channels received in adjacent spot beams in a satellite system. A need for more efficient decoding in satellite communications has become more apparent in recent years with the following number of users of such systems.

Processing a multi-user signal typically involves the quite separate tasks of channel estimation and decoding. Channel estimation is concerned with deriving certain channel parameters which uniquely distinguish the characteristics of each user signal that together comprise the multi-user signal. Knowledge of these channel parameters, such as power, oscillator phase and timing and frequency offsets, allows characteristics of each signal to be determined for use in later processing, notwithstanding the fact that each signal simultaneously exists in the communications channel.

Decoding on the other hand, is concerned with obtaining the actual value of the communicated data symbols that comprise each of the multi-user signals. Decoding is typically an iterative process where a probability of a symbol value (i.e., whether it is a 1 or 0) is refined and improved through multiple iterations. Many decoding algorithms require knowledge of channel parameters derived during the channel estimation phase.

The claimed invention is concerned with decoding, and is an improvement on known iterative decoding algorithms. The key feature of the invention is controlling the number of iterations used to decode a probability through terminating the iterative loop by reference to predetermined decoder convergence criteria, possibly before a probability is fully decoded. In this way, it will be realized that the invention provides an iterative decoding algorithm that is not of fixed complexity.

As discussed in the specification, this affords minimum complexity of receiver architecture for signal convergence, by preventing the system 'locking on' to a user signal before sufficient convergence is indicated.

This distinguishing feature has been incorporated into the claim language of independent claims 1 and 14 through the phrase 'wherein a probability is either partially or fully decoded depending on the application of decoder convergence criteria.'

Turning first to the Learned reference, the Examiner will note that it is concerned with channel estimation and not decoding. Learned's particular method of channel estimation involves making initial estimates of the parameters by utilizing an interference-free signal received on an 'acquisition channel to obtain channel training sequences transmitted to identify each user. Thereafter, as users are assigned a particular traffic channel, initial parameter values from the acquisition channel are utilized in tracking the parameters of each user.

When decoding is discussed (at paragraphs 49-85), only prior art techniques are mentioned, such as the Viterbi algorithm and the intersymbol interference tail-chopped exhaustive search. Both of these methods are of fixed complexity and do not involve or suggest either partially or fully decoding a probability based on predetermined convergence criteria. Hence, the Learned references does not teach or suggest the claim limitation, noted above, which is present in all of the application claims.

Chennakeshu describes a multi-signal canceling demodulator in which signals are demodulated simultaneously in an iterative fashion. Detected information obtained in each iteration is used as *a-priori* information for demodulation in the following step. While the reference is primarily concerned with demodulation (as opposed to decoding) of multi signals, the use of a decoder is also discussed. However, no particular decoding algorithms are mentioned at all, let alone ones involving variable complexity

as claimed in the present invention. Hence, this reference also fails to teach or suggest the above noted limitation which is present in all application claims.

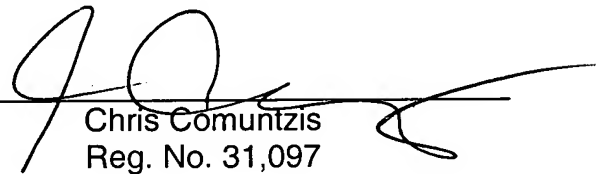
The above discussion provides clear examples of features of the claims which clearly distinguish the invention over the references cited to the Examiner.

Applicants further note that they have recently received a Notice of Allowance from the European Patent Office that indicates that a patent will be granted for the invention. In prosecution of this application, the Learned and Chennakeshu references were considered. A copy of the Notice and the allowed claims - which underwent minor formal amendment to overcome certain clarity objections raised by the EPO - is enclosed.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

By: \_\_\_\_\_

  
Chris Comuntzis  
Reg. No. 31,097

CC:lmr  
901 North Glebe Road, 11th Floor  
Arlington, VA 22203-1808  
Telephone: (703) 816-4000  
Facsimile: (703) 816-4100